BEVERAGE SUPPLY SYSTEM

by

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Cross Reference to Related Applications

This application is a continuation-in-part of United States Nonprovisional patent application Serial No. 10/227,672, filed August 27, 2002.

Field of the Invention

This application relates generally to bottled beverage supply systems and more particularly to a bottled beverage supply system that pumps beverage to a reservoir, which in turn supplies the beverage to a dispenser.

Background of the Invention

Due to high levels of impurities found in many domestic water supplies, a substantial number of households and offices prefer not to use their domestic water supplies as a source of drinking water, when making ice, or when making coffee or the like. As a consequence, such households frequently purchase bottled water for such uses. While there are numerous devices for dispensing bottled water and other bottled beverages for drinking purposes, it is considerably more difficult to supply bottled water to the icemaker or chilled water dispenser of a refrigerator. Typically, a water supply line for a refrigerator is connected directly to the domestic water supply, perhaps with a filter installed between them. Thus, if bottled water is to be supplied to a refrigerator, it should be supplied under a pressure comparable to that of the domestic water supply system.

Prior devices for supplying pressurized bottled water to a refrigerator or other water dispenser have not proven to be commercially viable. For example, some such systems have often required activation of a pump each time water is supplied to the dispenser. Thus, each time a user gets water from a refrigerator or otherwise uses the water supply, the pump is activated. This is both an annoyance to the user and a waste of energy. Other systems have required the use of a dip leg and its attendant inefficiencies, such as wasted water.

Accordingly there is a need for a reliable and convenient system for supplying water or other beverages from a bottle to a dispenser, such as a refrigerator. The present invention provides a solution to this and other problems, and offers other advantages over the prior art.

Summary of the Invention

Against this backdrop the present invention has been developed. An embodiment of the present invention is a beverage supply system. The system includes a beverage container having

a bottom outlet. A first reservoir is connected to the beverage container outlet to receive beverage from the beverage container under force of gravity. A pump is connected to the first reservoir, and a second reservoir is connected to the pump, the second reservoir defining an expandable beverage chamber. The pump is activated to pump beverage from the first reservoir to the second reservoir only when a first quantity of beverage in the first reservoir is within a first quantity range and a second quantity of beverage in the second reservoir is below a second quantity range. The system also includes a beverage dispenser connected to the second reservoir.

Stated another way, an embodiment of the present invention is a beverage supply system that includes a first reservoir adapted to receive beverage from a beverage container under force of gravity within a first quantity range. The system also includes a pump connected to the first reservoir, and a second reservoir connected to the pump. The second reservoir includes a solid barrier adapted to press against a second quantity of beverage within the second reservoir as the second quantity of beverage within the second reservoir displaces the barrier to produce a pressure. The second reservoir is adapted to supply beverage to a beverage dispenser without the pump being operated. The pump is activated to pump beverage from the first reservoir to the second reservoir only when a first quantity of beverage in the first reservoir is within the first quantity range and a second quantity of beverage in the second reservoir is below a second quantity range.

Stated yet another way, an embodiment of the present invention is a method of supplying beverage from a beverage container to a beverage dispenser. The method includes supplying beverage from a beverage container to a first reservoir. The method also includes pumping the beverage from the first reservoir to an expandable pressurized chamber of a second reservoir when a first quantity of beverage in the first reservoir is within a first quantity range and a second quantity of beverage in the second reservoir is below a second quantity range. The method additionally includes intermittently connecting the pressurized chamber to an outlet of a beverage dispenser to supply beverage from the second reservoir to the beverage dispenser without pumping the beverage from the second reservoir to the beverage dispenser.

These and various other features as well as advantages which characterize the present invention will be apparent from a reading of the following detailed description and a review of the associated drawings.

Brief Description of the Drawings

FIG. 1 is a schematic diagram of the beverage supply system according to an embodiment of the present invention.

FIG. 2 is a front perspective view of a beverage supply system according to an embodiment of the present invention.

FIG. 3 is a rear perspective view of the beverage supply system of **FIG. 2** with its access door removed.

FIG. 4 is a front separate perspective view of the support frame, the second reservoir, and the pump of the beverage supply system of **FIG. 2**.

FIG. 5 is a sectional view taken along line **5-5** of **FIG. 2**.

FIG. 6 is a separate sectional view of the second reservoir of the beverage supply system of **FIG. 2** with the beverage chamber empty.

FIG. 7 is a separate sectional view similar to **FIG. 6**, but with the beverage chamber being partially filled.

FIG. 8 is a separate sectional view similar to **FIG. 7**, but with the beverage chamber being more full than in **FIG. 7**.

FIG. 9 is vertical sectional view of a beverage supply system in accordance with an alternative embodiment of the present invention.

FIG. 10 is a schematic diagram of the alternative beverage supply system according to the present invention shown in **FIG. 9**.

FIG. 11 is a rear perspective view of the alternative beverage supply system of **FIG. 9** with its access door removed.

Detailed Description

Referring to **FIGS. 1-5**, a bottled beverage supply system **100** generally includes a beverage bottle or container **108**, such as a conventional water bottle, having an outlet **110** that feeds into a first reservoir **112**. A pump **114** pumps beverage from the first reservoir **112** to a pressurized second reservoir **116**. The beverage is then supplied from the second reservoir **116** to a beverage dispenser **118**. Because the second reservoir **116** is pressurized, beverage can be supplied from the second reservoir **116** to the beverage dispenser **118** without operating the pump **114**. The pump **114** only needs to be activated when the quantity of beverage in the second reservoir **116** becomes too low. Thus, the bottled beverage supply system **100** preferably supplies

pressurized beverage to the beverage dispenser **118** in an efficient manner without requiring the pump **114** to be constantly operated while beverage is being supplied to the beverage dispenser **118**.

Referring still to **FIGS. 2-3** and **5**, and describing the bottled beverage supply system **100** in more detail, a housing **130** has a substantially rectangular front wall **132**, a pair of substantially rectangular side walls **134** extending back from opposite side edges of the front wall **132**, and a substantially rectangular rear wall **136** extending between the rear edges of the side walls **134**. A substantially rectangular door opening **142** in the rear wall **136** provides access to the interior space of the housing **130**. A housing collar **144** extending about the periphery of the door opening **142** protrudes rearward, and a lip **146** extends up from the rear edge of the top of the housing collar **144** to define a channel **148** between the lip **146** and the rear wall **136**. A substantially rectangular door **156** spans the door opening **142**, but includes a cutout **158** from its bottom edge to provide limited access to the interior space of the housing **130** while the door is mounted on the housing **130**. The door **156** also includes a door collar **160** extending forward from the periphery of the door **156** and a lip **162** extending down from the front edge of the top of the door collar **160**. The door collar **160** fits around the housing collar **144**, and the door lip **162** extends down into the channel **148** so that the door lip and the housing lip **146** interlock. The door **156** also includes fastener holes **164** near its bottom edge to facilitate fastening the bottom of the door **156** in place.

A floor **170** of the housing **130** joins the bottom edges of the front wall **132**, the side walls **134**, and the rear wall **136** to form a bottom closure of the housing **130**. A support frame **172** is securely mounted on the floor **170** within the housing **130**. The support frame **172** includes a horizontal base **174**, a front wall **176** extending up from the front edge of the base **174**, and a reservoir pedestal **178** rising above the base **174**. A pair of reservoir support arms **180** extend up from front and rear sides of the reservoir pedestal **178** on opposite sides of the second reservoir **116**.

A top wall **182** of the housing **130** joins the top edges of the front wall **132**, the side walls **134**, and the rear wall **136**. A centrally located annular ridge **190** preferably protrudes upwardly from the top wall **182** and supports the body of the beverage bottle **108**. Referring to **FIG. 5**, the first reservoir **112** includes an annular side wall **210** that depends from the top wall **182** inside the annular ridge **190**. A sloped wall **212** slopes downward and inward from the side wall **210** to an outlet **214**. The outlet **214** preferably empties into a fitting **216**.

A drain apparatus **220** includes a support structure **222** that extends from the top wall **182** of the housing **130** down and into the first reservoir **112**. The support structure **222** supports a mating surface **224** that preferably abuts the rim of the downwardly facing outlet **110** of the bottle **108**. The support structure **222** is also preferably positioned and oriented to act as a guide to guide the outlet **110** toward the mating surface **224** when the bottle **108** is positioned on the beverage supply system **100**. A drain tube **226** also supported by the support structure **222** preferably extends up into the outlet **110**. The drain tube **226** includes top openings **228** at its upward end and a bottom opening **229** at its lower end. A drain tube flange **230** extends outwardly from the drain tube **226** and preferably seals with the mating surface **224**. Water is thus supplied to the first reservoir **112** through the drain tube **226** until the level of beverage in the first reservoir rises to the bottom opening **229** and prevents air from entering the drain tube **226**.

The housing **130**, the first reservoir **112**, the support structure **222** are all preferably part of a unitary member. The unitary member is preferably formed of structural polymer material such as a thermoplastic material. The unitary member can be formed by a roto-mold process. Alternatively, the body could be formed as separate members that are joined together. In this case, the body could be formed by a blow mold process.

A pump supply line **232** extends from the fitting **216** to the pump **114**. The pump **114** is preferably a positively displaced pump that can produce at least about 100 pounds per square inch of pressure. Alternatively, the pump could be some other type of pump in combination with a check valve to prevent backflow through the pump when the pump is not operated. Pump mounts **240** that are preferably arranged to prevent the transmission of vibrations between the pump **114** and the front wall **176** preferably mount the pump to the front wall **176** of the support frame **172**.

A pump exit line **242** extends from an outlet of the pump **114** to a second reservoir line **244**. The second reservoir line **244** extends to the second reservoir **116**. The second reservoir **116** preferably includes a pressure tank **250** having an inlet and outlet opening **252** attached to the second reservoir line **244**. A solid barrier or diaphragm **254** is preferably a thin flexible member that is secured to the sides of the pressure tank **250** and divides the pressure tank **250** into a beverage chamber **256** that opens into the opening **252**, and a gas chamber **258** that is filled with a pressurized gas such as air.

Referring to **FIG. 1**, a dispenser supply line **260** extends from the second reservoir line **244** to the dispenser **118**. The dispenser **118** preferably includes a dispenser valve **266** attached to the dispenser supply line **260** and a dispenser exit line **268**. The dispenser exit line may be connected to a spigot, an icemaker, or any other device for supplying beverage in liquid or solid form to users.

The various beverage supply lines may be constructed of any suitable material, but they are preferably standard polyethylene tubing such as is often used in supplying drinking water to refrigerators or other beverage dispensers.

A power supply **270** preferably supplies alternating current electrical power, such as from a standard 120-volt outlet. A power switch power line **272** and a constant supply power line **273** are both connected to the power supply **270**, with each power line **272**, **273** at a different voltage. Accordingly, the power supply **270** will supply power to electrical components that are connected to both the power switch power line **272** and the constant supply power line **273**. The power switch power line **272** is connected to a power switch **274**, which switches between one position that connects the power switch power line **272** to a pressure switch power line **275** and another position that connects the power switch power line **272** to an indicator power line **276**.

The pressure switch power line **275** extends to the pump **114** via a pressure switch **280** that is pneumatically connected to the beverage chamber **256** of the second reservoir **116** via the second reservoir line **244**. The pressure switch **280** preferably closes when the pressure within the beverage chamber **256** drops below a pressure range, and preferably reopens when the pressure within the beverage chamber **256** rises above the pressure range. The pressure range is preferably within the required pressure range for the dispenser **118**. The pressure range preferably has a lower limit of from about thirty-five to about forty-five psi, and an upper limit of from about sixty to about seventy psi. In a preferred embodiment, the lower limit of the pressure range is about forty psi and the upper limit is about sixty-five psi so that the pressure range is from about forty psi to about sixty psi. Accordingly, in a preferred embodiment, the pressure switch **280** closes when the pressure within the beverage chamber **256** drops below forty psi, opens when the pressure within the beverage chamber **256** rises above sixty-five psi, and does not switch when the pressure within the beverage chamber **256** is within the pressure range between forty and sixty-five psi.

The pump **114** is constantly connected to the constant supply power line **273**. Thus, when the power switch **274** connects the power switch power line **272** to the pressure switch power line

275, and the pressure switch **280** is closed, then the power supply **270** supplies power to the pump **114** and thereby activates the pump **114** to pump beverage from the first reservoir **112** to the second reservoir **116**.

The indicator power line **276** extends to an indicator light **282** that is preferably viewable by a user of the beverage supply system **100**. The indicator light **282** is also constantly connected to the constant supply power line **273** so that when the power switch **274** connects the power switch power line **272** to the indicator power line **276**, then the indicator light **282** receives power from the power supply **270** and is illuminated.

A fluid level switch power line **300** extends from the constant supply power line **273** to a fluid level switch **302**. The fluid level switch **302** is preferably driven by the fluid height of the beverage within the first reservoir **112**. Preferably, if sufficient beverage is within the first reservoir **112** to be pumped into the second reservoir **116**, then the fluid level switch **302** closes. Referring to **FIG. 5**, the fluid level switch preferably includes an annular float **304** that extends about a sealed cylinder **306** so that the float **304** is able to slide up and down on the sealed cylinder **306** as the beverage level within the first reservoir **112** rises and falls. A follower **308** positioned within the sealed cylinder **306** is magnetically attracted to the float **304** so that the follower **308** moves up and down with the float **304** to actuate the fluid level switch **302**.

Referring back to **FIG. 1**, the fluid switch power line **300** extends from the fluid level switch **302** to a relay **310** that actuates the power switch **274**. The relay **310** is preferably constantly connected to the power switch power line **272** so that the relay **310** receives power from the power supply **270** when the fluid level switch **302** is closed. Preferably, if the fluid level switch **302** is closed, indicating the fluid level within the first reservoir **112** is sufficiently high, and then the relay **310** switches the power switch **274** to connect the power switch power line **272** to the pressure switch power line **275**. If the fluid level switch **302** is open, then the relay **310** switches the power switch **274** to connect the power switch power line **272** to the indicator power line **276**, rather than the pressure switch power line **275**.

Thus, the power supply **270** will begin to supply power to activate the pump **114** if: (1) the pressure switch **280** is closed, indicating the pressure of the beverage within the second reservoir **116** is below the operating pressure range, which in turn indicates that the quantity of beverage within the second reservoir **116** is below an operating range; and (2) the fluid level switch **302** is closed, indicating the first reservoir **112** contains sufficient beverage to be supplied by the pump **114** to the second reservoir **116**. The power supply **270** will cease supplying power

to deactivate the pump **114** if either: (1) the pressure switch **280** opens, indicating the pressure of the beverage within the second reservoir **116** is above the operating pressure range; or (2) the fluid level switch **302** opens, indicating that the beverage level within the first reservoir **112** is not sufficiently high to continue supplying beverage to the second reservoir **116**.

In operation, the bottle **108** is placed in the inverted position shown in **FIGS. 2-5**. Referring to **FIG. 1**, at that time, beverage will fill the first reservoir **112**, as discussed above. This filled status is indicated to the relay **310** by the fluid level switch **302** as described above, and the relay will switch the power switch **274** to connect the power switch power line **272** to the pressure switch power line **275**. The second reservoir **116** may initially contain no beverage, so that the gas within the gas chamber **258** presses the barrier **254** against the sides and bottom of the tank so that the beverage chamber **256** has substantially no volume as shown in **FIG. 6**. In this state where the second reservoir **116** has no beverage or if its beverage level is low then its pressure is also low. This low beverage quantity and pressure status is indicated by the pressure switch **280** closing, and thereby connecting the pump **114** to the power switch power line **272** via the pressure switch power line **275** and the power switch **274**. The pump **114** is thereby operated to pump beverage from the first reservoir **112** to the beverage chamber **256** of the second reservoir **116**. As the pump **114** increases the quantity of beverage in the beverage chamber **256**, the pressure in the beverage chamber **256** also increases. The pressure of the beverage presses against and displaces the barrier **254** so that the beverage chamber **256** expands to accommodate the increasing quantity of beverage as shown in **FIGS. 7-8**. The pump **114** continues pumping beverage from the first reservoir **112** to the beverage chamber **256** of the second reservoir **116** until the pressure within the beverage chamber rises above the operating pressure range. At that point, the pressure switch **280** opens, thereby disconnecting the pump **114** from the power switch power line **272** and deactivating the pump.

Because the dispenser **118** is connected to the pressurized beverage chamber **256**, pressurized beverage is supplied to the dispenser **118**. The beverage may be automatically or manually dispensed from the dispenser **118** by opening the dispenser valve **266**. As the beverage is dispensed from the dispenser **118**, the quantity of beverage within the beverage chamber **256** decreases. The pressure within the beverage chamber **256** also decreases and the barrier **254** contracts the beverage chamber **256**. This contraction may continue during several uses of the dispenser **118** without the pump **114** being operated. Thus, users of the dispenser **118** are not

annoyed by the constant noise of the pump **114** as they use the dispenser **118**, making use of the dispenser **118** a more pleasant experience.

When the pressure within the beverage chamber **256** of the second reservoir **116** drops below the operating range, then the pressure switch **280** closes again. This will again operate the pump **114** so long as sufficient beverage remains within the first reservoir **112** as indicated by the fluid level switch **302** being closed. This cycle of beverage being supplied from the expandable beverage chamber **256** and the pump **114** operating periodically to supply beverage to the beverage chamber **256** continues so long as the first reservoir **112** contains sufficient beverage. When the beverage supply system **100** has emptied the bottle **108**, the bottle will, of course, no longer supply beverage to the first reservoir **112**, and the beverage level of the first reservoir **112** will drop until the first reservoir no longer contains sufficient beverage to be pumped to the beverage chamber **256** of the second reservoir. At that time, the float **304** of the fluid level switch **302** will also drop, and the fluid level switch **302** will open. The relay **310** will then switch the power switch **274** from the pressure switch power line **275** to the indicator power line **276**. With the pressure switch power line **275** disconnected from the power switch power line **272**, the pump **114** can no longer be operated, even if the pressure switch **280** is closed. With the indicator power line **276** connected to the power switch power line **272**, the indicator light **282** will remain on so long as the fluid level within the first reservoir **112** remains low. The indicator light **282** thereby indicates that the bottle **108** is empty and needs to be replaced with a new bottle. When the bottle **108** is replaced, then operation of the beverage supply system **100** continues as described above.

If the beverage supply system **100** needs to be disconnected from the dispenser **118**, the bottle **108** can be removed. The beverage within the system **100** can then be drained by simply opening the dispenser valve **266**. The dispenser **118** can then be disconnected. Alternatively, a valve could be included on the dispenser supply line **260**. This valve could be closed before disconnecting the dispenser **118**.

An alternative embodiment **400** of the beverage supply system in accordance with the present invention is shown in **FIGS. 9, 10** and **11**. A schematic diagram is shown in **FIG. 10**. A sectional view is shown in **FIG. 9**, and a perspective view of the system **400** is shown in **FIG. 11**. In this alternative embodiment, the system **400** is designed to accommodate an external source of beverage supply in addition to a bottle supply as in beverage supply system **100**. The components and operation of the system **400** are the same as in system **100** described in detail

above except for the addition of a provision for connection of the system to a feed from an external source, such as a reverse osmosis water purification system (not shown) through a port **402** that passes through the wall **132** to a line **404** which connects to a tee fitting **406** in the feed line **232** to the pump **114**, and the provision of a switch contact **412** to bypass the float switch **302** as described below.

In **FIGS. 9, 10,** and **11**, the same numbering of components is utilized as in the first embodiment **100** described above except for the additional components added. In particular, a valve **408** is placed between the outlet fitting **216** and the tee **406** in the line **232**. This valve **408** remains open whenever the system **400** is operated as described with reference to system **100**. This valve **408** is preferably a solenoid valve, with a hand switch operator handle **409** on the outside of the cabinet, as is shown in FIG. **11**, although it may alternatively be a manual valve as well. In this alternative embodiment **400**, the bottle water source preferably may be utilized only if the external system is unavailable. This might be desirable, for example, in a commercial environment or a home environment where the water needs are greater than can be economically handled with single bottles. In such situations, a reverse osmosis water purification system might be in place. The output of this external system is provided as an input to system **400** via port **402**. Beverage passes through the port **402**, through line **404**, tee **406**, and into the pump **114** as needed. Should the external system be taken off line for any reason, a water bottle **108** would be installed, solenoid valve **408** opened via switch **409**, and the system **400** operated as above described with reference to system **100**. A solenoid stop/check valve **410** in the feed line **404** prevents backflow of bottle water through the port **402** into the external system. In actual operation, the external system may predominate in supplying the beverage to the pump **114**, while a bottle **108** is installed and simply provides either an automatic backup source for the system **400** if valve **408** is chosen appropriately as a solenoid operated stop/check valve, or manual backup source for the system **400** if valve **408** is a hand valve.

In the case where a bottle **108** is not installed in the first reservoir **112** during normal operation, a circular cap would be installed over the opening into reservoir **112** that engages the annular ridge **190** in the top wall **182**. When it is desired to install a bottle **108**, the cap would simply be removed and stored inside the housing of the system **400**.

Referring now to FIG. **10**, a perspective view is shown. Note that valve **408** has a handle **409** protruding through the cabinet front. This handle is the solenoid operator for valve **408**. In operation, the valve **408** not only closes off the first reservoir **112** while the external system is

supplying beverage to the second reservoir through the pump **114**, the control for this valve, the handle **409** on the front of the unit, has a switch contact **412** that bypasses the float switch **302** so that when a bottle **108** is not installed, the pump **114** will continue to operate as previously described to provide beverage through the external supply to the second chamber **256** being maintained within the desired pressure range.

It will be clear that the present invention is well adapted to attain the ends and advantages mentioned as well as those inherent therein. While a presently preferred embodiment has been described for purposes of this disclosure, various changes and modifications may be made which are well within the scope of the present invention.

For example, the second reservoir could operate without a solid barrier by having the second reservoir contain a compressed gas that is further compressed by the beverage itself as the second reservoir is filled. Also, the electrical components could be configured in many different ways. In alternative embodiment **400**, the valve **408** shown in Figure **10** may be simply replaced with a check valve and a simple switch provided on the side of the enclosure to bypass the float switch **302** when an external source is operational or engage the float switch **302** when a bottle **108** is installed. Alternatively, the switch contact **412** may be omitted if the valve **408** is closed during external source use and a bottle **108** is installed on the first reservoir **112**. The check valves in the system could be replaced with stop/check valves to ensure isolation capability in case of leaks or other malfunctions, as well as support automatic operation of the system **400** with either bottle or external supply. The placement of the port **402** may be other than the wall **132**. It may be located in any location that is convenient for the connection to the reverse osmosis system. The placement of the handle or switch **409** for valve **408** may be other than on the side **132**. This valve actuator may be internal to the enclosure rather than having a handle placed as shown in **FIG. 11**. Numerous other changes may be made which will readily suggest themselves to those skilled in the art and which are encompassed in the spirit of the invention disclosed and as defined in the appended claims.